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Welfare-improving policy on medical tourism and labor productivity: A theoretical analysis

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ABSTRACT

This paper considers welfare and wage inequality effects of developing medical tourism on the host country from a theoretical point of view. Due to the competition between public healthcare provision and medical tourism, the development of medical tourism might reduce labor productivity and thus widen wage inequality via the increased wage rates of healthcare workers and decreased wage rates of production workers. In addition, the expansion of medical tourism can lower social welfare of the host country through a decline in labor productivity caused by reduced public healthcare provision. A tax-subsidy welfare-improving scheme is suggested to mitigate the unfavorable productivity effect of medical tourism on the host economy. This theoretical result fits into current empirical evidence on medical tourism.

1. Introduction

Travel for medical reasons has a long history, while due to globalization and surges in income in last two decades medical tourism has been transformed from a small-scale cottage business to a worldwide billion-dollar industry (Ramirez de Arellano, 2011). Prior to the outbreak of COVID-19 in early 2020, the tourism industry had been a major pillar in many economies while medical tourism was a fast-growing sector, in which people travel abroad to access medical treatment. Types of medical tourism can be classified broadly into two categories: leisure tourism along with minor medical services, and health tourism with major medical treatments. The former type considers leisure as the main goal for traveling with minor medical treatments such as cosmetic surgery, whereas the latter is largely for treatments in health with minor tourism. Thus, easily accessible medical services are keen to the former type, while affordable costs of medical treatments are concerned for the latter.

The aspects regarding health and medical tourism can be considered from source and destination countries. Rising income in Asian emerging economies in China, Hong Kong, Taiwan, etc. makes people to travel to developing countries majorly in Southeast Asia for leisure tourism along with minor medical services like cosmetic surgeries. Governments in India, Malaysia and Thailand have

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implemented policies to establish themselves as regional medical destinations. In addition, to attract patients from medical expensive regions in North America and Western Europe, countries in Latin America and Eastern Europe, including Brazil, Cuba and Mexico as well as Hungary, Poland and the Czech Republic, have invested heavily in healthcare and infrastructure for healthcare services, accompanying with some tourism (Virani et al., 2020).

As pointed out in Connell (2011), the main destinations of medical tourists are the developing economies. The rapid surges of medical tourism make those economies uneven developed between urban and rural areas. The growing interest in considering medical tourism can be thus attributed to foreign-exchange generation that helps economies. Developing medical tourism leads to urban bias and privatization, causing migration of healthcare workers from public hospitals to urban private clinics. Besides, promoting medical tourism causes internal brain drain by relocating health workers from healthcare to medical tourism within hospitals (Chen and Flood, 2013; Beladi et al., 2015). Furthermore, diverting limited healthcare resources to foreign patients may endanger healthcare provision to domestic residents. These crowding-out effects on medical workers and domestic patients impede labor productivity and economic growth of destination countries. Therefore, medical tourism threats rather than helps domestic healthcare providers, alters national healthcare systems, and causes economic and social questions (Connell, 2011). Beladi et al. (2015) provide empirical evidence that the expansion of medical tourism sector is associated with a decrease in labor productivity.

In a recent article, by comparing cross-national differences in research and policy on medical tourism in terms of source and destination countries, Virani et al. (2020) find that research on medical tourism does not always address prevailing policy challenges. To fill in the lacuna between theoretical research and policy recommendations, this paper re-examines the real impact of medical tourism on the economy, with a particular attention to the consequent change in labor productivity in the economy. Due to the crowding-out effect on limited medical resources, it is shown that a rise in medical tourism can reduce healthcare services to production workers, thereby lowering labor productivity in the economy. This can reduce the wage rate of production workers while increasing the wage rate of healthcare workers. Despite the revenue, the expansion of medical tourism might lower social welfare via a fall in labor productivity caused by reduced public healthcare provision.

From the policy point of view, to overcome the unfavorable productivity effect of developing medical tourism to the country, governments need to introduce complementary policies to promote medical tourism, such as redistributing the revenue generated from medical tourism into the public healthcare system. Cuba has been successful in using revenue generated from its health spa and health tourism to reinvest in its public healthcare system (Lunt et al., 2015). One policy option to mitigate the adverse effect of medical tourism is the tax-subsidy scheme, in which a tax is imposed on medical tourism revenue and the tax revenue is then used to cross-subsidize the provision of domestic public healthcare services (Whittaker, 2015).

The purpose of this paper is thus to consider such a tax-subsidy scheme to mitigate the unfavorable productivity effect of medical tourism on the host economy. We find that this tax-subsidy policy, i.e., taxing foreign tourists to subsidize the suffered domestic healthcare sector, can not only raise labor productivity but also improve welfare, because cross-subsidization can reverse migration of healthcare workers from the medical tourism sector to the domestic healthcare sector. Production workers thus receive more healthcare services, which can raise labor productivity. We show theoretically that such a complementary policy via a tax-subsidy scheme can be welfare-improving to the host economy. This welfare-improving tax-subsidy scheme is consistent with the policy to develop medical tourism in Cuba. The notable Cuba's success in exporting medical and health services to the United States in several decades is that healthcare services to local residents are not crowded out by medical services to foreign tourists (Ramirez de Arellano, 2011).

The organization of this paper is as follows. Section 2 provides a compact review on medical tourism to the host economy. Using a general-equilibrium model with medical tourism, Section 3 addresses the relationship between public healthcare and labor productivity, and the effects of promoting medical tourism on wage inequality and social welfare are investigated. Section 4 provides a tax-subsidy policy recommendation to have a win-win solution to the economy. In addition, the optimal tax level of medical tourism on foreign tourists is discussed. Concluding remarks are given in Section 5.

2. The literature review

This section provides a compact literature review on medical tourism by focusing on the demand factors for medical tourism and its impacts on growth and inequality.

2.1. Demand factors on medical tourism

In light of tourism being a fast-growing competitive industry worldwide, medical tourism had been quickly developing as a part of tourism for health and wellness care in developing countries prior to Covid-19 started in early 2020. There are economic and non-economic factors influencing the development of medical tourism. Quality, cost, and ease to travel and access are the major economic factors affecting medical tourism in a developing country. Mishra and Sharma (2021) claim quality being the top consideration for the selection of healthcare countries and providers even for price-conscious inbound tourists to India. The priority on quality for medical tourism in terms of human and technological factors is also identified in Malaysia (Nilash et al., 2019). By comparing medical services between home and destination countries for the residents of Hong Kong, Saiprasert et al. (2021) show that perceived medical quality turns out to be the key element in influencing people's intention on choosing medical tourism. The result on medical quality provides a business strategy by investing cutting-edge technologies and employing well-trained physicians in response to the booming business of medical tourism.

As for health tourism, cost plays an important consideration, especially for tourists from advanced countries. Mishra and Sharma

(2021) state that the significantly low costs in healthcare services is one of the reasons behind India attracting customers from western countries and the middle east. Pagan and Horsfall (2019) mention that India is a major chosen country by UK residents to be treated overseas. On the other hand, ease to travel and access is a considerable factor for leisure tourism. As a premier healthcare destination, India has made policies to ease travel for medical tourism purposes.

Beside the economic reasons, individuals' intention is also a crucial factor in affecting medical tourism. Ban and Kim (2020) investigate how foreigners' health beliefs influence their visiting intentions to Korean medical tourism. Susceptibility, severity, barrier and benefit, being the four dimensions to serve as valid measures on health beliefs of destination countries, have significant effects on visiting intention. Chaulagain et al. (2020), using data collected from 246 US residents, further claim that perceived behavioral control and subjective social norm positively influence individuals' intention to engage in medical tourism, while a moderating effect of perceived severity is found on attitude and intention, compared to perceived benefits and barriers, to medical tourism. The findings offer practical implications in the context of medical tourism.

2.2. Growth and inequality

By using a meta-regression analysis, Fonseca and Rivero (2019) survey the relationship between tourism and income in the sense of Granger causality, and conclude the tourism-led growth hypothesis: The higher degree of tourism specialization in the country, the greater the level of economic development is. He and Li (2021) extend the study with a panel data from 2006 to 2015 to confirm the significantly positive effect of tourism on income. For the country study, Salehi-Esfahani (2021) show a positive long-term effect of U.S. tourism demand on overall health-related tourism spending in Canada during the period of 1986–2016.

Zuo and Huang (2019) further argue that tourism can influence economic growth by the so-called Lewis hypothesis regarding the spillover effect of tourism on economic restructuring and sectoral labor productivity, while a positive spillover effect of tourism on industrialization and economic growth is empirically identified for the China's data. Following the Lewis hypothesis, Beladi et al. (2015) consider the sectoral restructure caused by medical tourism. A rise in inbound medical tourism in developing economies can increase the wages in the medical tourism sector. Thus, the medical tourism sector expands but the domestic healthcare sector contracts. This lowers labor productivity in the country. Medical tourism can thus raise domestic welfare if the benefit from the expansion of tourism outweighs the loss from the decline in labor productivity.

The effect of tourism on labor productivity is especially worrisome for promoting medical tourism in developing countries. Beladi et al. (2019) empirically investigate the effect of medical tourism on labor productivity by addressing the consequent effect on crowding out. A rise in medical tourism may crowd out the provision of public healthcare services to domestic residents, which in turn causes a decline in workers' productivity. Using a panel data, they empirically demonstrate that medical tourism has a positive effect on output growth in the host countries, particularly in non-OECD countries, but is causes a negative effect on labor productivity. The output contribution of medical tourism is thus over-estimated by an average of 26.8% if the detrimental productivity decline was not taken into consideration.

These results on sectoral and aggregate outputs discussed above provide useful insights for managing the niche business of medical and health tourism in both developing and developed economies. Nonetheless, studies on the distribution and equity effects of medical tourism remain void.

3. The benchmark model and analysis

The economy consists of three sectors: the goods sector X, the public healthcare sector Y and the medical tourism sector Z. Good X is traded internationally. Selecting good X as the numeraire, the domestic prices of public healthcare services Y and medical tourism goods Z are presented by p and q, which are determined in the host country.

The host country receives foreign tourists for medical tourism. Foreign tourists visit the host country by demanding medical tourism services, m_i^*, with n varieties, $i = 1, \ldots n$. The CES composite of medical tourism services from n varieties is expressed by $M^* = (\Sigma m_i^{*\rho})^{1/\rho}$, which yields utility $v(M^*)$, with $0 < \rho < 1$ and $v'(\cdot) > 0$. Following Copeland (2012), individual foreign tourist first minimizes the expenditure of the composite M^*, i.e., min $\{\Sigma q_i m_i^* : (\Sigma m_i^{*\rho})^{1/\rho} = M^*\}$, to obtain the demand for medical service m_i^* as $m_i^* = Q^{\sigma} M^* / q_i^{\sigma}$, where $\sigma = 1/(1-\rho)$, representing the degree of substitution between varieties. Note that $Q = (\Sigma q_i^{1-\sigma})^{1/(1-\sigma)}$ is the price index for a unit composite of medical tourism services ($M^* = 1$). Individual tourist then chooses the quantity of the composite of medical tourism services, M^*, to maximize consumer surplus, $v(M^*) - QM^*$. This yields $v'(M^*) = Q$, which gives the individual demand for the composite medical tourism services as a function of the price index Q by $M^* = M^*(Q)$, with $dM^*/dQ < 0$. Total demand for medical tourism services m_i^* by foreign tourists is thus aggregated as $D_Z^* = m_i^* T^*$, where T^* is the number of foreign tourists to capture a shift variable of medical tourism (cf., Copeland, 1991). Under symmetric equilibrium, $m_i^* = m^*$ and $q_i = q$, total demand by foreign tourists for medical tourism services m^* is thus expressed by $D_Z^* = D_Z^*(q, T^*)$, with $\partial D_Z^*/\partial q < 0$ and $\partial D_Z^*/\partial T > 0$.

Domestic residents demand traded goods, D_X, healthcare services, D_Y, and medical tourism composite, M, where $M = (\Sigma m_i^{\rho})^{1/\rho}$, and the utility function is $U(D_X, D_Y, M) = D_X + u(D_Y) + v(M)$, with $u'(\cdot) > 0$ and $v'(\cdot) > 0$. Welfare maximization yields the corresponding demand for healthcare services by $D_Y = D_Y(p)$. The (inverse) demand function for healthcare services Y can be expressed by: $p = p(D_Y)$, with $p' < 0$. Because healthcare services are non-traded, domestic demand, D_Y, equals the supply, Y, provided in the host economy. This gives: $D_Y = Y$ and hence $p = p(Y)$. Analogous to foreign demand for medical tourism, demand for medical tourism services m by domestic residents is $D_Z = D_Z(q)$ for the given domestic residents.

Since medical tourism services are non-traded, the equilibrium condition requires its total supply z for service m meets total demands by domestic residents and foreign tourists in the host country:

$$z = D_Z(q) + D_Z^*(q, T^*). \tag{1}$$

It is noted that different from Beladi et al. (2015), medical tourism services m are demanded not only by foreign tourists but also by domestic residents. In many countries, the development of medical tourism initially aimed at foreign tourists. Nonetheless, the number of international tourists has been substantially lowered since early 2020 when the global pandemic of Covid-19 started. The industry of medical tourism has then switched to focus on domestic consumers. To reflect this fact, medical tourism is demanded not only by foreign tourists but also by domestic residents in this paper.

In the production side of the economy, the traded-good sector produces good X by employing production workers, L_X, and domestic capital, K_X, under a constant returns-to-scale technology: $X = X(aL_X, K_X)$, where a expresses the health status of production workers and is positively associated with the healthcare services received; that is, $a = a(Y)$ with $a'(\cdot) > 0$. This productivity-externality effect is the unique feature for modeling medical tourism in a general-equilibrium setup since it can crowd out healthcare services to production workers. Therefore, aL_X measures the *effective* labor input in the production of good X, and the corresponding *effective* wage rate is w_L/a, where w_L denotes the wage rate of production workers, i.e., $\partial X/\partial L_X = w_L$. In the competitive equilibrium of good X, we have:

$$c^X(w_L/a, r) = 1 \tag{2}$$

where $c^X(\cdot)$ expresses unit cost of producing good X, and r is the rental rate on domestic capital.

Consider the public healthcare sector in the host economy. Providing healthcare services requires healthcare workers, along with the fixed capital input. Total cost for the production of public healthcare services Y is: $C^Y(w_s, r, Y) = F(r) + c^Y(w_S)Y$, where w_S denotes the wage of healthcare professionals and $c^Y(w_S)$ is the marginal cost to produce healthcare services Y. The host government provides public healthcare services for welfare consideration. The associated welfare, W, can be captured by consumer surplus, CS, and profit, π_Y, where $CS = u(D_Y) - pD_Y$ and $\pi_Y = p(Y)Y - C^Y(w_s, r, Y)$. This leads to $W = u(D_Y) - C^Y(w_s, r, Y)$. Maximizing welfare W yields:

$$p(Y) = c^Y(w_S) \tag{3}$$

This gives the marginal cost pricing for the public healthcare services.

As for the medical tourism sector, in response to medical advancements and enhanced well-being, the market in the host economy is booming with keen competition by n providers of medical tourism. Each provider produces one variety of medical tourism services under monopolistic competition. Advanced foreign medical equipment is employed to attract customers, and its cost comes from hiring domestic healthcare workers and using foreign medical equipment: $C^z(w_s, r^*, z) = f(r^*) + c^Z(w_S, r^*)z$, where r^* denotes the user cost of foreign medical equipment and $c^Z(w_S, r^*)$ is the marginal cost of producing one unit of medical tourism z. The profit is therefore $\pi_Z = qz - C^Z(w_s, r^*, z)$. In addition, healthcare workers are employed with the wage rate w_S in the sector. The medical tourism sector is operated privately under profit maximization (Connell, 2011). Profit maximization yields the equality between marginal revenue (MR) and marginal cost as follows:

$$\rho q = c^Z(w_S, r^*) \tag{4}$$

It is remarked that $MR = q(1 - 1/\sigma)$ and $\sigma = 1/(1 - \rho)$. This market assumption on monopolistic competition is adapted from Beladi et al. (2015).

In the monopolistically competitive market of medical tourism, providers are free entry/exit. This leads to zero profits. In equilibrium, from the zero-profit condition, $qZ = f(r^*) + c^Z(w_S, r^*)z$ and using (4), we obtain:

$$(1 - \rho)qz = f(r^*) \tag{5}$$

That is, cost of foreign equipment is fully covered from revenue.

For the factor markets, L production workers are supplied in the traded good sector X, while its effective labor supply is aL, adjusted by the health condition of workers by noting $a = a(Y)$ with $a' > 0$. In equilibrium, this leads to:

$$c_w^X(w_L/a, r)X = aL \tag{6}$$

Note that, $c_w^X = \partial c^X/\partial(w/a)$, being the effective labor demand for producing one unit of goods X from the envelop property. Subscripts of the cost function are used to denote partial derivatives.

Moreover, the market equilibrium conditions for healthcare workers, domestic capital and foreign medical equipment are given by:

$$c_w^Y(w_S)Y + c_w^Z(w_S, r^*)nz = S \tag{7}$$

$$c_r^X(w_L/a, r)X + F_r(r) = K \tag{8}$$

$$c_r^Z(w_S, r^*)nz + nf_r(r^*) = K^* \tag{9}$$

where c_w^Y ($= \partial c^Y/\partial w_S$) and c_w^Z ($= \partial c^Z/\partial w_S$) express respectively the unit demands for healthcare workers to provide public healthcare services Y and medical tourism services z, F_r ($= \partial F/\partial r$) and c_r^X ($= \partial c^X/\partial r$) are the demands for domestic capital as the fixed and production inputs in sector X, and f_r ($= \partial f/\partial r^*$) and c_r^Z ($= \partial c^Z/\partial r^*$) denote the demands for foreign equipment as the fixed and production inputs in the medical tourism sector. In addition, S and K expresses the fixed supplies of healthcare workers and domestic capital in the host country, and K^* is the supply of foreign medical equipment. It is noted that the supply of skilled labor S is given to

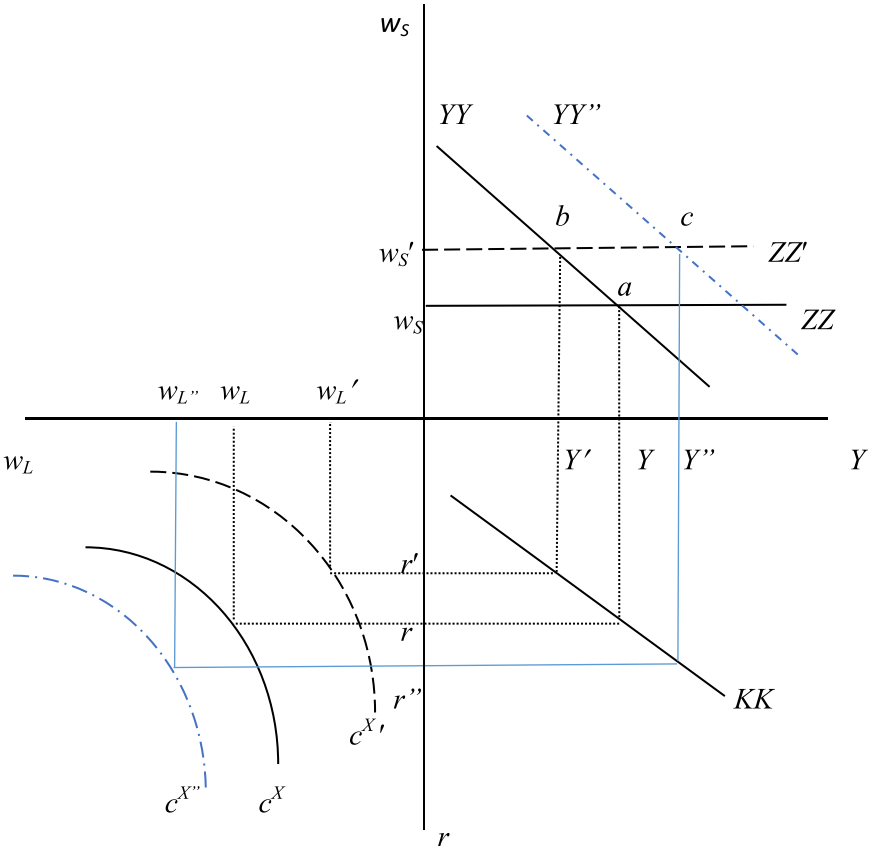

Fig. 1. Wage and welfare effects of medical tourism, Note: w_S: skilled wage, w_L: unskilled wage, r: capital rental rate, Y: public healthcare provision.

confine the analysis on domestic movement of skilled labor between the public healthcare and the private medical tourism sector, rather than international migration of skilled labor between countries considered in Beladi et al. (2015).

Fig. 1 depicts the effects of changes in the medical tourism price, q, on the supply-side variables of the economy. Schedules YY and ZZ in the northeast quadrant express, respectively, the goods market equilibrium conditions of public healthcare services and medical tourism, as stated in (3) and (4). Initially, the equilibrium is at point a. From (4), a rise in the price, q, of medical tourism (by shifting schedule ZZ to ZZ' and consequently moving the equilibrium point from point a to b) increases the demand for healthcare workers; hence, their wage rate rises:

$$\partial w_S/\partial q = 1/c_w^Z > 0 \tag{10}$$

However, a higher cost of healthcare workers lowers the provision of public healthcare services in sector Y according to (3):

$$\partial Y/\partial q = (c_w^Y/p')(\partial w_S/\partial q) < 0 \tag{11}$$

The fall in output, Y, of the public healthcare services lowers the demand for domestic capital expressed by (8), thereby lowering the capital rental rate:

$$\hat{r}/\hat{Y} = g\lambda_{KX}\theta_{LX}/A > 0 \tag{12}$$

where $A > 0$ and $\hat{Y} = dY/Y$ ("^" expresses a percentage change of a variable).[1] Note that λ_{ij} and θ_{ij} in (12) denote, respectively, the employment and cost shares of factor i in sector j (Jones, 1965), while $g = (da/a)/(dY/Y)$ expresses the percentage change of the effective measure of labor demand in sector X. This relationship is depicted in schedule KK in the southeast quadrant of Fig. 1.

Moreover, from (6), the reduced health service, Y, lowers labor productivity in sector X and hence reduces the output of good X by:

$$\hat{X}/\hat{Y} = g(s_{KX} + \theta_{KX}s_{KY})/A > 0 \tag{13}$$

where $s_{KX} = \sigma_X\lambda_{KX}\theta_{LX}$ and so forth, and σ_X signifies the factor substitution of labor and capital in sector X.[2] This leads to reductions in the demand for production labor and domestic capital in sector X. Further, the lowered rate of domestic capital returns, expressed in the southeast quadrant of Fig. 1, results in factor substitution by using more capital for labor. This places a pressure on the wage rate of production workers. From (2), the market equilibrium condition of good X, the overall change in the wage rate and then the rental rate can be solved as:

$$\theta_{LX}\hat{w}_L + \theta_{KX}\hat{r} = g\theta_{LX}\hat{Y} \tag{14}$$

Solving (12) and (14) leads to:

$$\hat{w}_L/\hat{Y} = g[\lambda_{KX}(\sigma_X - \theta_{KX}) + \lambda_{LX}\theta_{LX}s_{KY})]/A = g[\lambda_{KX}(\sigma_X - \theta_{KX}) + \lambda_{LX}\theta_{LX}s_{KY})]/A \tag{15}$$

Therefore, this leads to: $\hat{w}_L/\hat{Y} > 0$ if $\sigma_X > \theta_{KX}$. The wage of production workers can be lower ($dw_L/dq < 0$) when factor substitution between domestic capital and production workers in sector X is sufficiently large. This result is illustrated in Fig. 1. As expressed in the southwest quadrant of Fig. 1, the decrease in domestic healthcare services, Y, causes the iso-unit cost curve to shift inwards from c^X to $c^{X\prime}$, yielding a lower wage rate for production workers in sector X ($dw_L/dq < 0$).

Note that a rise in q lowers the production of good Y by (11). This causes a movement of healthcare workers away from the public healthcare sector Y into the medical tourism sector z. From (5) and (7), the number of medical tourism providers rises which then crowds out the output of each provider:

$$\hat{n}/\hat{q} = [(s_{SY} + s_{SZ})/\lambda_{SZ}](\hat{w}_S/\hat{q}) - (\lambda_{SY}/\lambda_{SZ})(\hat{Y}/\hat{q}) - \hat{z}/\hat{q} > 0 \tag{16}$$

$$\hat{z}/\hat{q} = -1 \tag{17}$$

By using (1) and (17), it is possible to solve the effect of an expansion of medical tourism from more foreign tourists (i.e., a rise in T^*) on the domestic price q of medical tourism services z, as follows:

$$dq/dT^* = q(\partial D_z^*/\partial T^*)/z(\varepsilon + \varepsilon^* - 1) \tag{18}$$

where $\varepsilon = -(\partial D_Z/\partial q)(q/z)$ and $\varepsilon^* = -(\partial D_Z^*/\partial q)(q/z)$ denote respectively the price elasticities of demands for medical tourism services z by domestic residents and foreign tourists. Since $\partial D_z^*/\partial T^* > 0$, we have $dq/dT^* > 0$ in (18) when the Marshall-Lerner condition is satisfied (i.e., $\varepsilon + \varepsilon^* > 1$) for stability.[3].

We consider next the welfare effect of developing medical tourism on the host economy. Domestic consumers' preference is: $U = D_X + u(D_Y) + v(M)$, with $D_Y = D_Y(p)$, $M = M(Q)$ and $D_X = I - pD_Y - QM$, where $M = (\Sigma m_i^{\rho})^{1/\rho} = n^{1/\rho}m$ and $Q = (\Sigma q_i^{1-\sigma})^{1/(1-\sigma)} = n^{1/(1-\sigma)}q$ under symmetric equilibrium. National income, I, consists of GDP net of the payment to foreign capital: $I = X + pY + QZ - r^*K^*$, where $Z = (\Sigma z_i^{\rho})^{1/\rho}$ is the production of the medical tourism composite. The indirect utility function is given by: $V = V(p, Q, I)$, where $V_p = -D_Y$, $V_Q = -M$ and $V_I = 1$. Therefore, the welfare effect of a change in medical tourism by foreign tourists can be obtained as follows:

$$dV/dT^* = M^*(dQ/dT^*) + (w_L/a)a'L(dY/dT^*) \tag{19}$$

where $dQ/dT^* > 0$ by (16) and (18) and $dY/dT^* < 0$ according to (11) and (18).[4] Note that $M^* = (\Sigma m_i^{*\rho})^{1/\rho} = n^{1/\rho}m^*$ under symmetric equilibrium. The development of medical tourism from more foreign tourists benefits the host economy via an improvement in the tourism terms of trade ($dQ/dT^* > 0$). Nonetheless, this gain could be mitigated or outweighed by the decline in labor productivity, caused by less provision of public healthcare services ($dY/dT^* < 0$). This crowding-out effect on public healthcare services can reduce welfare (or real output) of the host economy. By setting $dV/dT^* = 0$ in (19), the optimal composite level of medical tourism by foreign tourists is therefore obtained, as follows:

$$M^* = -(w_L/a)a'L(dY/dT^*)/(dQ/dT^*) > 0 \tag{20}$$

where $M^* = n^{1/\rho}m^*$ under symmetric equilibrium. From the welfare aspect, the optimal level of foreign demand on the medical tourism service m^* is a partial demand of domestic supply z (i.e., $m^* < z$) by (1), and its level needs to be greater to remedy the loss of the induced decline in labor productivity when the tourism terms-of-trade effect is not large.

4. A welfare-improving policy

To tackle with the problem of the unfavorable decline in labor productivity, governments can introduce complementary policies to promote medical tourism, such as redistributing the revenue generated from medical tourism into the public healthcare system. As mentioned in Lunt et al., (2015), Cuba has been successful in using revenue generated from its health spa and medical tourism to reinvest in its public health system. One policy option to mitigate the detrimental effect of medical tourism on labor productivity is the tax-subsidy scheme, in which a tax is imposed on medical tourism revenue and the tax revenue is then used to cross-subsidize the provision of domestic public health services (Whittaker, 2015).

Under the tax-subsidy scheme, the government introduces a subsidy s to the healthcare service sector Y. The associated welfare generated by the sector becomes: $W = CS + \pi_Y + sY = u(D_Y) - C^Y(w_s, r, Y) + sY$. To maximize welfare, marginal cost pricing in sector Y follows:

$$p(Y) + s = m(w_S) \tag{3}$$

To finance the subsidy cost, a tax can be levied on foreign tourists (such as a visa fee), in which the financing constraint is:

$$sY = tT^* \tag{21}$$

where t denotes a tax on foreign tourists.

Under this tax/subsidy scheme, from (3′) and (4), the subsidy to production adds another channel to affect the provision of public

healthcare services:

$$\partial Y/\partial s = -1/p' > 0 \tag{22}$$

Thus, from (11) and (22), we have $Y = Y(q, s)$ under the tax/subsidy scheme on medical tourism with $\partial Y/\partial q < 0$ and $\partial Y/\partial s > 0$. This output effect in (22) is illustrated by a right shift of schedule YY to YY'' in the northeast quadrant in Fig. 1 (from point b to c). As a result, reverse migration by attracting more healthcare workers to the public healthcare sector can happen. Consequently, from (7), the number of medical tourism providers falls:

$$\hat{n}/\hat{s} = -(\lambda_{SY}/\lambda_{SZ})(\hat{Y}/\hat{s}) < 0 \tag{23}$$

By including this negative impact on the number of providers in the medical tourism sector, the medical tourism sector contracts. Differentiating $sY = tT^*$ from (21) and using $Y = Y(q, s)$ leads to.

$$ds/dT^* = [t - s(\partial Y/\partial q)(dq/dT^*)]/[Y + (\partial Y/\partial s)] > 0 \tag{24}$$

This suggests that the greater the tax level from medical tourism, the larger the production subsidy rate given to the public healthcare sector. Therefore, using $Y = Y(q, s)$ leads to:

$$dY/dT^* = (\partial Y/\partial q)(dq/dT^*) + (\partial Y/\partial s)(ds/dT^*) > (<) 0 \tag{25}$$

An expansion of medical tourism can increase the provision of public healthcare services ($dY/dT^* > 0$) if the subsidy-induced output effect stated in the second term on the right side of (25) is strong. In this case, as depicted in Fig. 1 by shifting the iso-unit cost curve $c^{X\prime}$ outwards to $c^{X\prime\prime}$, the increase in medical tourism by foreign tourists can raise the wage rate of production workers in the host economy.

Under the tax-subsidy scheme by cross subsidization, the welfare effect of expanding medical tourism by foreign tourists becomes:

$$dV/dT^* = t + M^*(dQ/dT^*) + (w_L/a)a'L(dY/dT^*) \tag{26}$$

Medical tourism directly gives a tax revenue (volume-of-trade) effect and indirectly yields a favorable tourism term-of-trade effect by exporting medical services to foreign tourists. Further, the tax-financed subsidy can raise labor productivity if the subsidy-induced output effect on public healthcare provision is strong ($dY/dT^* > 0$). In this case, the expansion of medical tourism can unambiguously improve social welfare of the host country ($dV/dT^* > 0$) in (26). From (1), it would be then optimal by providing medical tourism services to foreign tourists only:

$$M^* = Z \tag{27}$$

where $M^* = n^{1/\rho}m^*$ and $Z = n^{1/\rho}z$ under symmetric equilibrium. That is, all the tourism services provided in the host country will be fully demanded by foreign tourists ($m^* = z$) for generating tourism revenue to cross-subsidize the domestic healthcare sector.

We summarize the results on medical tourism with the tax-subsidy welfare-improving scheme, as follows:

Proposition: The development of medical tourism can have detrimental effects on welfare and wage inequality by the decline in labor productivity. Nonetheless, implementing a tax-subsidy scheme is one way for policymakers to potentially offset these negative effects by generating and channeling additional revenue from medical tourism services to cross-subsidize public healthcare in the host country.

The development of medical tourism can help the host economy by increasing the wages of production workers and improving the welfare of the economy, if the country adopts a scheme of taxing foreign tourists and then financing the public healthcare sector. Cross-subsidization can be done by taxing foreign tourists, and the optimal level of medical tourism is the full demand of medial tourism services by foreign tourists. This policy recommendation is feasible in policy design by not only attracting foreign tourists but also maintaining domestic healthcare sector. Furthermore, reverse migration of healthcare workers from the medical tourism to the public healthcare sector might happen if the tax revenue generated is not too limited. This policy and its implications are not considered in Beladi et al. (2015).

It is of interest to further investigate the optimal tax level on foreign medical tourism to enhance the contribution of the tax/subsidy scheme.[5] By using indirect utility function $V = V(p, Q, I)$ and income $I = X + pY + QZ + tT^* - r^*K^*$, the welfare effect of a change in the tax level t on foreign medical tourism can be obtained as

$$dV/dt = T^* + (w_L/a)a'L(\partial Y/\partial s)(ds/dt) \tag{28}$$

where $\partial Y/\partial s > 0$ by (22). It is noted from $sY = tT^*$ in (21), we have $ds/dt = T^*/[Y + (\partial Y/\partial s)] > 0$. Thus, a rise in the tax level on foreign tourism improves welfare of the host country ($dV/dt > 0$) in (28). The optimal tax level (t^o) can be then set by the host government to extract foreign consumer surplus, as follows.

$$t^o = v(M^*) - QM^* \tag{29}$$

where recalling that $v(\cdot)$ expresses the utility of a foreign tourist from the medical tourism composite. That is, the government can use the tax policy on medical tourism to shift consumer surplus of foreign tourists to the domestic healthcare sector. In this case, domestic welfare will be maximized.

5. Conclusions

This paper has examined economic effects of medical tourism by addressing the issue that due to limited medical resources, a rise in medical tourism might crowd out provision of public healthcare services to workers. This can lower labor productivity in the economy, thereby reducing the unskilled wage rate but raising the skilled wage rate. The development of medical tourism can have not only a detrimental effect on wage inequality but also lower the welfare of the host country through a decline in labor productivity caused by less provision on public healthcare. To overcome the problem of the decline in labor productivity, a tax-subsidy scheme is proposed by taxing medical tourism on foreign tourists and using the revenue to finance the public healthcare sector. The development of medical tourism via the cross-subsidization scheme can thus raise the wage rate of production workers and improve welfare of the host country.

Implementing such a tax-subsidy scheme is one way for policymakers to potentially offset the negative productive effect by generating and channeling additional revenue from medical tourism services to cross-subsidize public healthcare in the host country. From a theoretical point view, this tax-subsidy policy by cross subsidization can mitigate the migration problem, and furthermore, reverse-migration from the private tourism sector to the public healthcare sector can happen if the subsidy is largely enough. In reality, in many economies, such as Taiwan, medical tourism can also be performed in public hospitals with self-financing. This can provide an incentive for physicians to retain in the public health system, while earning additional income from private practices. The tax on medical tourism can shift the consumer surplus of foreign tourists to the domestic healthcare sector. In this case, domestic welfare can be maximized.

A concern related to the tax-subsidy scheme on medical tourism is that consumers and interest groups are likely to resist tax interventions. Nonetheless, besides the quality, demands for health and medical tourism depend on price elasticities of tourist demands. In general, demand for health tourism may be less inelastic. The imposition of tax might be feasible and it can be largely shifted to consumers. This might reflect the tax case of health tourism implemented in Cuba. On the other hand, for leisure tourism with minor medical services, due to tax competition, a tax scheme may be not so effective, compared to the case under health tourism.

Footnotes

1. $A = \lambda_{LX}(s_{KX} + \theta_{LX}s_{KY}) + \lambda_{KX}s_{LX} > 0$.
2. $\sigma_X = c^X c^X_{wr}/c^X_w c^X_r$, being the elasticity of substitution between domestic capital and production workers in sector X. See also, Beladi and chao et al. (2006).
3. By expressing the time derivative as a dot above a variable, the dynamic adjustment of the domestic medical tourism market can be specified as: $\dot{q} = \alpha[D_Z(q) + D^*_Z(q, T^*) - Z(q)]$, where $\alpha > 0$. Undertaking linear approximation of the equation leads to: $\dot{q} = \alpha[\partial D_Z/\partial q + \partial D^*_Z/\partial q + Z/q]dq = \alpha(Z/q)[(\partial D_Z/\partial q)(q/Z) + (\partial D^*_Z/\partial q)(q/Z) + 1]dq = -\alpha(Z/q)(\varepsilon + \varepsilon^* - 1)dq$. Hence, stability requires $\varepsilon + \varepsilon^* > 1$.
4. Under symmetric equilibrium, we have $dQ/dT^* = n^{1/(1-\sigma)}(dq/dT^*) + [1/(1-\sigma)]n^{\sigma/(1-\sigma)}(dn/dT^*) > 0$ by (16) and (18).
5. We thank a referee for suggesting this point.

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